IRRESPONSIBLE USE OF CHATGPT IMPEDES ACADEMIC PERFORMANCE

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Abstract: *With the fast adoption of generative artificial intelligence (AI) tools in education, this study aims to explore the impact of these tools, including ChatGPT, on students and the overall learning process, particularly focusing on the irresponsible usage of ChatGPT and its implications on academic performance. The study analyzed a sample of 116 university students, both traditional and online, to measure the effects of irresponsible ChatGPT usage on academic performance, using quantitative exam results as the metric. The findings reveal a significant negative impact of irresponsible ChatGPT usage on academic performance. This negative relationship is particularly pronounced among online students who have less interaction with teaching staff. These findings expand the theoretical understanding of AI tools' impact on education and provide practical implications for the academic community. The findings highlight the need for building students' and teachers' capabilities for responsible AI usage.*

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INTRODUCTION

The integration of artificial intelligence (AI) into contemporary higher education has transformed teaching practices by implementing and incorporating a range of tools and potential development opportunities. The launch of ChatGPT, the most prominent AI application, is considered to be the greatest disruption in education since the start of calculators (Haque et al., 2022; Mamula Nikolić, 2024). However, this rapid integration has brought with it certain academic ethical dilemmas and questions on the real impact this technology has on students' development, engagement, satisfaction or academic performance.

The significant impact of ChatGPT in higher education is evident in how it is used, whether irresponsibly or responsibly (Hashmi and Bal, 2024) and to what extent. While AI can improve teaching and learning, it can also disrupt student motivation and focus and develop excessive resilience (Zhou et al., 2023). Various prior studies highlight the benefits of AI, such as expanding learning resources (Qadir, 2023), personalized learning (Hong, 2023), and positive impact on critical thinking and cognitive achievement (Jaboob, Hazaimeh, and Al-Ansi, 2024). However, certain negative aspects and risks of ChatGPT usage have also been identified. These can be compromised academic integrity and reduced student performance (Dwivedi et al., 2023), propagation of inherent biases and hallucinations (Ivanov et al., 2024), overreliance on AI (Qawqzeh, 2024) and impeded critical thinking, evaluative and analytical skills of students (Royer, 2024; Vargas-Murillo, de la Asuncion Pari-Bedoya, and de Jesús Guevara-Soto, 2023). Particularly vulnerable are the students who have fewer interactions with their tutors (Farrelly and Baker, 2023), especially remote online students (Xu et al., 2023). To determine the impact on academic attainment most studies applied self-reported judgments (El-Seoud et al., 2023; Qawqzeh, 2024). Addressing these new challenges requires transforming not only the education system by

introducing new forms of learning and assessment (Raitskaya and Lambovska, 2024), aimed at both students and teachers.

This study aims to research the effect of ChatGPT use, and particularly the irresponsible usage of this tool, on the academic performance of university students. The study examines the relationship between ChatGPT use and academic performance, focusing on key variables such as type of study (traditional or online), instances of irresponsible ChatGPT use, and academic performance as measured by final exam points. The sample is a cohort of 116 students from the Faculty of Management at a private University in Serbia. Data is analysed using the Orange Data Mining tool, exploring different statistical models and visualising the findings.

The remainder of the paper covers a relevant Literature Review which informs the hypothesis formulation in Methodology, together with study design and analytical framework explanation. Results are featured in a separate section, followed by a Discussion exploring the main findings, theoretical and practical contributions, limitations and future research. The paper closes with Conclusions.

LITERATURE REVIEW

The consequences of ChatGPT use in education are still an open topic for academic research. The field is still nascent, posing numerous perspectives to the problem.

Benefits of ChatGPT

Many educational institutions have progressed towards using AI tools such as ChatGPT to enhance the learning environment. Customized feedback and guidance provided by these technologies significantly help students, offering quick access to knowledge (Yu, 2024; Chan and Hu, 2023; Qadir, 2023). Students often perceive ChatGPT as a "helpful friend", providing support and guidance throughout their learning process (Šedlbauer et al., 2024). According to El-Seoud et al. (2023), the advantages of Chat GPT as a tool in education are reflected in the quick completion of tasks and easy access to data. The authors identify various positive implications, such as increased access

to information and resources, improved student engagement, better understanding of complex topics, and personalized learning. ChatGPT and similar tools are viewed as useful research aids, helping students to generate ideas and sythesize information (Chan and Hu, 2023). Students' views on their experience with ChatGPT tend to be positive. Qawqzeh (2024) identified significant enhancements in the cognitive domain and improved learning experience. Qualitative research by Šedlbauer et al. (2024) established evidence of enhancing the critical thinking of students, although not all are enthusiastic about the use of this tool. The use of AI can be caused by the time pressure students feel, finding the efficiency of ChatGPT as a helpful solution to the issue (Abbas, Jam, and Khan, 2023; Royer, 2024).

Methods to identify the form and scale of ChatGPT's impact on students vary. Most studies measure attitudes and perceptions (Farrelly and Baker, 2023; Šedlbauer et al., 2024; Jaboob, Hazaimeh, and Al-Ansi, 2024). Ivanov et al. (2024) apply the Theory of Planned Behavior to find that improving lecturers' and students' perspectives on the advantages of implementing generative AI tools could be associated with a more positive attitude, subjective norms and perceived behavioural control toward the use of such tools in education at universities. A study among university students in three Arab countries revealed that generative AI techniques and applications have a positive and significant impact on student behavior and cognitive achievement (Jaboob, Hazaimeh, and Al-Ansi, 2024).

A particular aspect of research on ChatGPT benefits relates to relevance and impact on remote students. Positives of self-regulated learning techniques in terms of validated effectiveness on academic achievement in online or blended learning were identified by Xu et al. (2023). Their findings are not specific to the assistance of generative AI solutions, still, they are valuable in identifying that interactive metacognitive prompts in remote learning positively correlate with academic performance. With the aid of AI tools, remote learning can be improved with automatic tests and assignments adjusted to student's level of knowledge and learning pace (Kasneci et al., 2023).

There is a gap in existing literature in identifying, quantifying and predicting the direct impact of ChatGPT use on students' academic results. Literature also indicates varying impacts on learning depending on the level of teacher supervision and support (Qawqzeh, 2024; Kasneci et al., 2023).

Risks of ChatGPT

Despite all the advantages that are shown through numerous studies, ChatGPT also carries with it certain risks. Namely, one of the key risks faced by teachers, according to the study by Mosaiyebzadeh et al. (2023), is data privacy, which is reflected in the sensitivity of students' data when they are used for illicit purposes that do not belong to education. Then, the lack of fact-checking of content produced on demand by Chat GPT, the lack of references that Chat GPT often omits, and of course plagiarism, accidental or purposeful. Regarding the risks that concern students directly, frequently found are cheating on exams (Farrelly and Baker, 2023; Dwivedi et al., 2023; Mosaiyebzadeh et al., 2023). In cases of ChatGPT misuse, teachers face the risk of biased grading (Cotton, Cotton, and Shipway, 2024), and compromised assessment process (Eken 2023). Without crosschecking the output of ChatGPT-generated text, students risk a decrease in critical thinking and cognitive performance (Qawqzeh, 2024; Rudolph, Tan, and Tan, 2023). Students tend to express unwillingness to question the AI-generated output (Šedlbauer et al., 2024), which is a capability that should be improved. The ability to interrogate the AI output, to evaluate it and to further create from it are skills proposed to be added to Bloom's taxonomy (Ng et al., 2021).

In addition to above mentioned, specific risks are heightened in remote learning environments with online students. Lack of regular engagement with the tasks as well as with the teachers hinders students' progress and performance (Bravo-Agapito, Romero, and Pamplona, 2021). Such support from tutors is critically needed when students start using ChagtGPT and other AI tools without sufficient knowledge and guidance (Farrelly and Baker, 2023).

In a study by Abbas, Jam and Khan (Abbas, Jam, and Khan, 2023) which examined the causes and consequences of ChatGPT usage among university

students, findings show that the use of ChatGPT was likely to increase tendencies for procrastination and memory loss and reduce the students' academic performance. Also, students who rely on generative AI alone may not necessarily do well in their assessments and consequently get lower grades (Lim et al., 2023). Capability for critical thinking is viewed as the key skill that higher education should nurture in students which is undermined if the use of ChatGPT is not properly guided and integrated into coursework (Royer, 2024).

ChatGPT and Ethics

The most common concerns related to the usage of ChatGPT in an academic environment are the ethics of such behaviors and academic integrity. Eken (2023) stated that the integration of ChatGPT in education can have ethical challenges, compromising the basic values of education. In certain cases, students may fail to distinguish AI-generated content from the original work or reference to other sources (Šedlbauer et al., 2024). There are still missing conventions and agreements between universities and the academic community on how to site ChatGPT content in different academic materials. Implementing practical guidelines can assist in creating informed decisions and shaping policies within educational institutions.

In two separate studies (Farhi et al., 2023; Mijwil et al., 2023) it is concluded that using ChatGPT in education has useful and concerning effects on educational integrity. Violations of scientific research and publication ethics can have serious consequences, including damage to the reputation of the researchers, journals, and institutions involved. As such, it is crucial that all researchers and publications adhere to these ethical standards to maintain the integrity of the scientific community (Mijwil et al., 2023).

Recognizing the complexities and importance of ChatGPT usage, teachers and policymakers can keep a balance by leveraging Artificial Intelligence technology to improve education while upholding ethical practices that promote critical thinking, originality, and integrity among students (Farhi et al., 2023).

Results from the review approach revealed that major concerns linked to ChatGPT

were in the ethics, copyright, transparency, and legal issues. Other considerations included bias, plagiarism, absence of originality, inaccurate content leading to false educational and professional narratives, limited knowledge, incorrect citations, cybersecurity susceptibilities, and the risk of spreading misinformation (Dwivedi et al., 2023; Chan and Hu, 2023; Farhi et al., 2023; Cotton, Cotton, and Shipway, 2024). There is growing concern that originality is increasingly threatened in various domains, ranging from completing homework assignments to conducting academic research (Lund et al., 2023; Rudolph, Tan, and Tan, 2023). As Chan and Hu (2023) stated, ChatGPT for brainstorming creative concepts related to education is an effective tool today. Using ChatGPT solely for generating creative ideas about education can be a positive approach as it promotes original thinking and prevents overreliance.

Regonizing that ChatGPT can be used both constructively and transparently, as well as for the purpose of deception and or substitution for individual work, Hashmi and Bal (2024) propose a useful academic typology of ChatGPT usage. The main discriminant is whether the tool is used responsibly or irresponsibly, in a transparent or opaque manner. Irresponsible AI users are classified as Savvy Cheaters in case of transparent usage, or as AI illiterate in case of opaque usage. The aim is to teach students how to use AI responsibly and transparently, understanding when and where to use AI tools and recognizing the ethical implications of AI.

There is a gap in existing literature in identifying, quantifying and predicting the direct impact of ChatGPT use on students' academic results. Literature also indicates varying impacts on learning depending on the level of teacher supervision and support (Qawqzeh, 2024; Kasneci et al., 2023). There is very little research on the direct impact of ChatGPT usage, especially under limited supervision circumstances, and online students' academic achievement.

METHODOLOGY

Considering the identified research gap, this paper aims to answer one main research question: whether the irresponsible usage of AI impacts students'

academic performance. A limited number of prior research studies explore the effects of ChatGPT use on academic performance. Even less use quantified academic achievement measured by GPA scores (Abbas, Jam, and Khan, 2023), but rely on self-reported perceptions of academic performance (El-Seoud et al., 2023; Šedlbauer et al., 2024; Qawqzeh, 2024). Applying the academic typology related to AI use proposed by Hashmi and Bal (2024b) and the proposition that irresponsible use of AI impedes academic integrity as well as learning amplification, our main research question is whether the irresponsible usage of AI impacts students' academic performance.

Hypothesis formulation

Prior research studies have mainly looked at the use of ChatGPT in an academic context from the perspective of benefits and risks for both students and teachers. Some of the identified risks are related to the propagation of inherent biases or hallucinations (Ivanov et al., 2024), or the advent of new types of plagiarism and issues with academic integrity (Hashmi and Bal, 2024; Ivanov et al. 2024). Special category of risk is related to the deskilling of students (Ivanov et al., 2024), overreliance on AI (Qawqzeh, 2024) and impeded students' independent critical thinking, analytical and evaluative skills (Qawqzeh, 2024; Royer, 2024; Vargas-Murillo, de la Asuncion Pari-Bedoya, and de Jesús Guevara-Soto, 2023). The impact of AI use on academic performance was established in previous studies, mainly measured via self-reported perceptions (El-Seoud et al., 2023; Qawqzeh, 2024) and qualitative evaluations (Šedlbauer et al., 2024). In the tests conducted, students were either asked to use ChatGPT or to openly report on their experience with ChatGPT. There is an open question on how undisclosed and inappropriate usage of ChatGPT impacts students' learning and ultimately whether it reflects on their exam scores.

Hypothesis H1: Irresponsible usage of ChatGPT negatively impacts academic performance.

Another perspective on ChatGPT usage in an academic context is how it is treated by the academic institution. Some institutions encourage it, provide

relevant education for both teachers and students and support ChatGPT use intended for improving the learning experience and students' critical thinking. Supervision and appropriate training can be seen as the enablers of AI usage that will yield beneficial outcomes (Qawqzeh, 2024). Lack of it can lead to breaches of academic integrity, unethical or just ignorant use of AI tools. That can lead to lower performance on assessments and lower grades (Lim et al., 2023).

Hypothesis H2a: Online students are more likely to use ChatGPT irresponsibly.

Hypothesis H2b: Online students who use ChatGPT irresponsibly are more likely to underperform on exams.

Study design

To answer the research question, we have conducted research among students of the Faculty of Management at a private University in Serbia. The sample included all students who attended and passed the exams for three courses: Consumer Behavior, Digital Marketing and Advertising during the school year 2023/24. The total sample included 116 cases. For each case following data was recorded: type of study (traditional or online), irresponsible usage of ChatGPT for project assignment (yes or no), and points on the final exam (0–30). The rationale for these variables is provided in the following paragraphs.

The Faculty of Management offers two modes of study. The traditional mode requires students to attend lectures and to complete all their pre-exam assignments regularly during the semester. These students have frequent and direct interactions with faculty members. Online students are given access to course materials and pre-exam assignments online. They complete and submit required assignments at their own pace, without direct faculty supervision. All students have to attend the exam live. This difference in the level of interaction with faculty and ad hoc approach to covering the course material is assumed to have an impact on the quality of academic output of online vs traditional students.

One of the pre-exam assignments on each of the three selected courses is a project task. This is a written essay that is supposed to demonstrate a student's ability to solve a concrete problem, applying the knowledge taught in the course. Students select one of the topics from the list provided by the teacher. Only up to three students can apply for the same topic. The essay is about 15 pages in length. It is supposed to encompass about two-thirds of the course content. Upon essay submission, students and teachers discuss it orally, in the classroom for traditional students or online for online students. The pedagogical purpose of the project task is to prepare students for the final exam and to enable them to deploy course content in practice. The assumption is that students who take this project seriously are more likely to do better on the final exam. To summarize the reasons why this assignment was chosen to be checked for ChatGPT irresponsible usage: this is a written essay as a form; it requires students to independently, on their own, conduct research and generate content; it is broad in scope and therefore supposed to be good preparation for the final exam if done right.

Identification of irresponsible, undisclosed or opaque use of AI (Hashmi and Bal, 2024) is not a simple problem. Directly copying ChatGPT-generated text without disclosure is just one of the forms of academic integrity violations (Perkins et al., 2024). Determining whether an essay is written by a human or by LLM-based generative AI tools like ChatGPT is not easy. There are numerous tools developed for this purpose, but their reliability and accuracy are still an issue (Farrelly and Baker, 2023), especially if the content has been adapted from AI-generated output. One of the most frequently used tools for this purpose is Turnitin AI Detect (Perkins et al., 2024), despite reported issues with false positives and false negative rates (Farrelly and Baker, 2023). A recent comparison of AI detection tools (Driessen, 2024) shows that tools like Scribbr or QuillBot have the best accuracy rates and no false positives. Since QuillBot does not support the Serbian language, we have opted to use the Scribbr AI detection tool. The purpose of this check was not to determine the average use of ChatGPT in students' essays but rather to identify blunt violations of responsible ChatGPT use. Judgment on questionable content was grounded on well-known guidelines

for AI-generated text, as explained by Cotton, Cotton and Shipway (2024). We have defined this as direct copying of ChatGPT-generated text into the essay, without referencing, checking for accuracy, language check (ChatGPT does not produce fully accurate text in the Serbian language) or proper integration and interpretation of the content. Cases marked to have used ChatGPT irresponsibly were those that were found to have a significant part of the essay identified as 100% AI generated using the Scribbr AI detection.

Finally, academic performance is measured by points achieved on the final exam and not the overall grade students get. Since 70% of the grade is based on pre-exam assignments, including the project task, we wanted to record exam achievement separately from pre-exam efforts. Exams are taken in writing, requiring students to answer a set of questions for a limited amount of time. Tracking just exam points versus overall grade for the course is assessed to be a better measure of academic performance for the purpose of this research.

The conceptual model developed for this study is illustrated in Figure 1. Academic Performance is the outcome variable, while Type of Study and Irresponsible ChatGPT Usage are dependent variables. The interaction between the dependent variables assumes that the Type of Study could impact the proclivity for Irresponsible ChatGPT Usage.
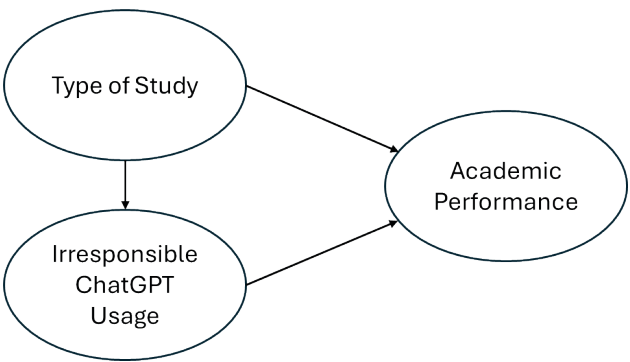
Figure 1. Study conceptual model

Analytical framework

Data were analyzed using the Orange data mining tool, version 3.37.0. „Orange is a machine learning and data mining suite for data analysis through Python scripting and visual programming" (Demšar et al. 2013). It is one of the oldest, open-source, data mining Python-based tools. It has been widely used in various domains, including education (Abdelmagid and Qahmash 2023; Hussain et al. 2019). It is a hierarchically organized toolbox of data mining components enabling analysis like regression, decision trees, clustering, classifications, association rules, projections and others. Orange combines statistical methods and powerful data visualisation possibilities.

Results

From our data set of 116 cases, we have the following descriptive statistics about the sample, as shown in Table 1:

Table 1. Sample details

Variable	Value	Count	Percent
Type of Study	Traditional (1)	31	27%
	Online (0)	85	73%
ChatGPT Usage	Yes (1)	50	43%
	No (0)	66	57%

During the 2023/24 school year, a total of 116 students passed the Consumer Behavior, Digital Marketing and Advertising courses, 27% of them being traditional students. The data shows that 43% of students were identified to have used ChatGPT irresponsibly for their project task.

Since Exam Points was a numerical variable recording values from 0–30, its values are shown in Figure 2, using the Feature Statistics visualisation in Orange.
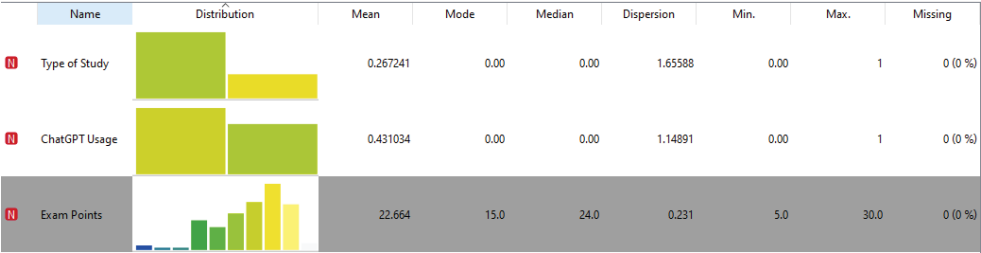
Name	Distribution	Mean	Mode	Median	Dispersion	Min.	Max.	Missing
N Type of Study		0.267241	0.00	0.00	1.65588	0.00	1	0 (0 %)
N ChatGPT Usage		0.431034	0.00	0.00	1.14891	0.00	1	0 (0 %)
N Exam Points		22.664	15.0	24.0	0.231	5.0	30.0	0 (0 %)

Figure 2. Feature statistics visualisation

Data in Figure 2 show that the Mean value for Exam Points is 22.664, with a minimum of 5 points and a maximum of 30 points achieved. Students needed to achieve a minimum of 15 points to pass the exam.

A comparison of mean scores on Exam Points for ChatGPT Usage is shown in Figure 3 and for Type of Study in Figure 4. Student's t-test score of 2.034 indicates a smaller difference relative to variability for ChatGPT Usage than for Type of Study (Student's t: 4.715). Calculated p values in both cases are below the 0.05 threshold meaning that there is a statistically significant difference between the two group means, although the evidence is less strong for ChatGPT Usage compared to Type of Study.
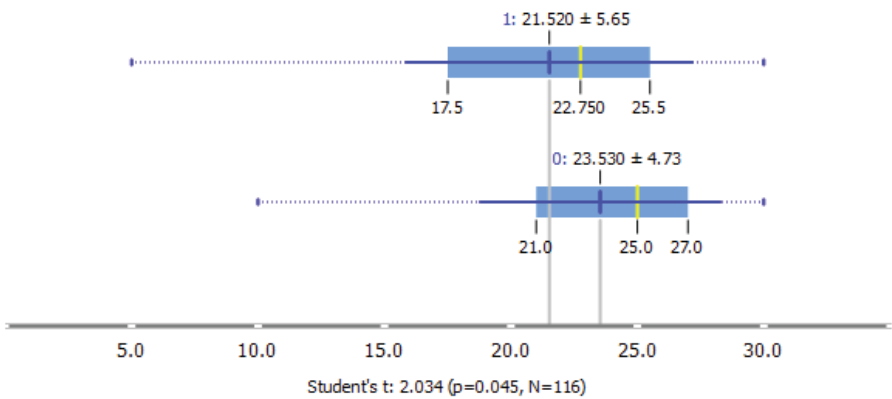

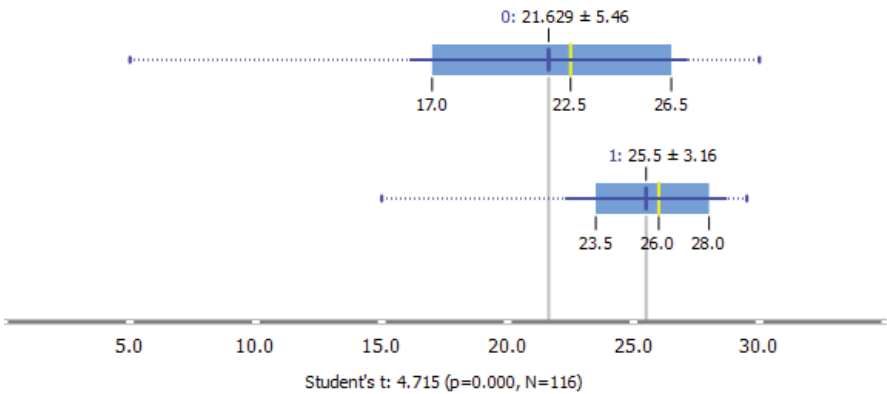Figure 3. Exam Points means comparison by ChatGPT Usage

Figure 4. Exam Points mean comparison by Type of Study

These differences in data are visualised in Figures 5 and 6 via normal distribution curves. While points achieved on exams show a similar distribution curve between students who used ChatGPT and those who did not (Figure 5), there is a noticeable difference in the distribution of exam points between traditional students (red curve in Figure 6) and online students (blue curve in Figure 6).
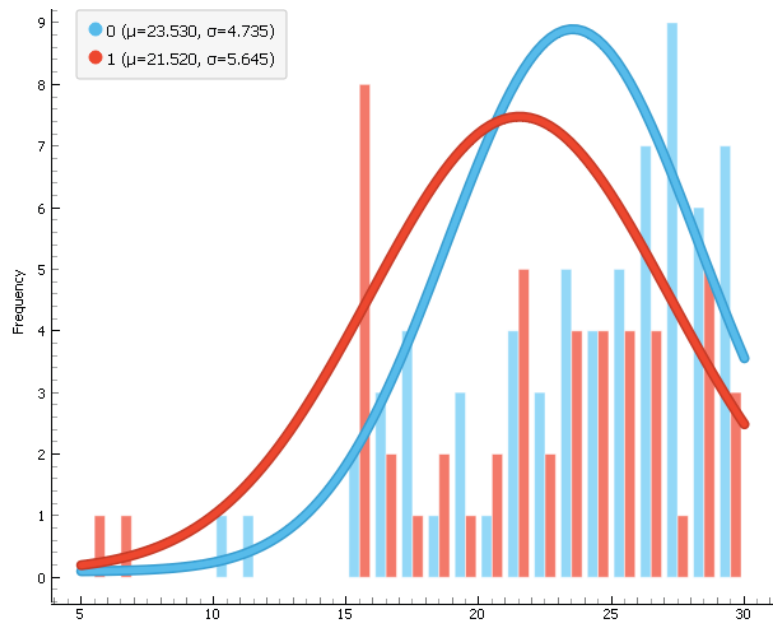
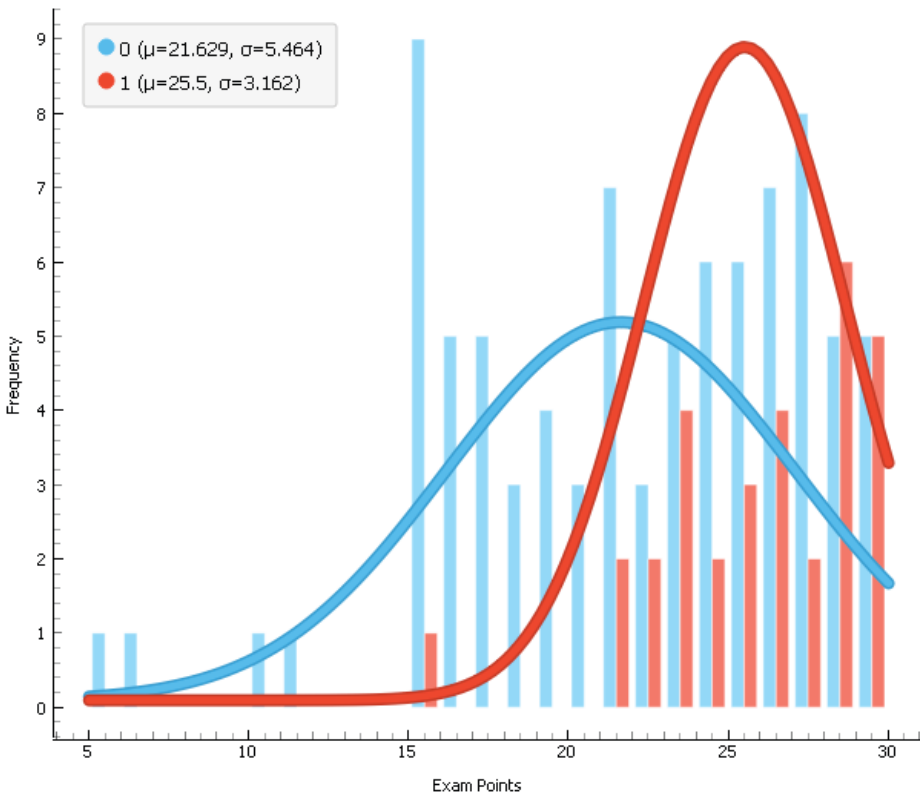Figure 5. Exam Points Distribution by ChatGPT Usage

Figure 6. Exam Points Distribution by Type of Study

To measure the strength and direction of the linear relationship between variables, Pearson correlation coefficients were calculated and are shown in Figure 7. There is a moderate positive relationship between Exam Points and Type of Study. As points increase, the higher the likelihood that the student is a traditional one. The value of -0.190 suggests a weak negative correlation between ChatGPT Usage and Exam Points. The tendency for the variables to move in opposite directions is present but not very pronounced. This means that directionally if a student uses ChatGPT irresponsibly, achieved exam points will tend to be lower. With these findings, we can accept H1 that irresponsible use of ChatGPT has a negative impact on academic performance, although that impact is not very strong.
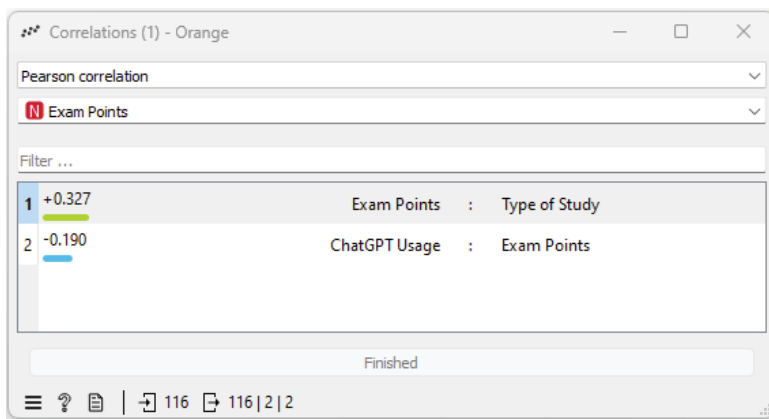
Figure 7. Pearson correlation coefficients

Another way to look at the relationships between these variables is the use of a decision tree as a classifier with a multistage approach to determining basic leadership de-complexing choices (Mohi 2020). For the Exam Points set as the target i.e. dependent variable, the decision tree hierarchy is shown in Figure 8.
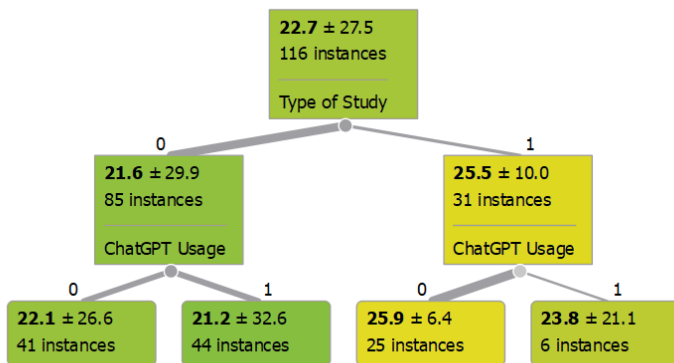

Figure 8. Decision Tree

If Exam Points are a dependent outcome variable, the Type of Study is the first sub-level of influence and ChatGPT Usage is secondary. For Type of Study 0 (online), there are 85 instances. The level below is ChatGPT Usage with almost equal split: 41 instances of 0 i.e. online students who did not use ChatGPT

irresponsibly, and 44 instances of 1 i.e. online students who used ChatGPT irresponsibly. The other side of the Decision Tree shows 31 instances of Type of Study 1 (traditional students). On the branch below ChatGPT usage shows 25 instances of 0 (not used) and only 6 instances of 1 (used). The thickness of the lines between branches indicates the significance between expected and actual instances.

Applying the k-means analysis Orange tool suggests that 4 separate clusters fully explain the data (Figure 9). These clusters are visualised in Figure 10. Darker colors indicate the tendency for lower exam scores for C1 (online students that do not use ChatGPT irresponsibly) and C2 (online students that use ChatGPT irresponsibly). The highest exam scores are in the C3 cluster of traditional students who do not use ChatGPT irresponsibly. There is finally C4: the smallest cluster of traditional students that use ChatGPT irresponsibly with diverse exam scores – there are both those with average or above average exam scores and those with below average exam scores.
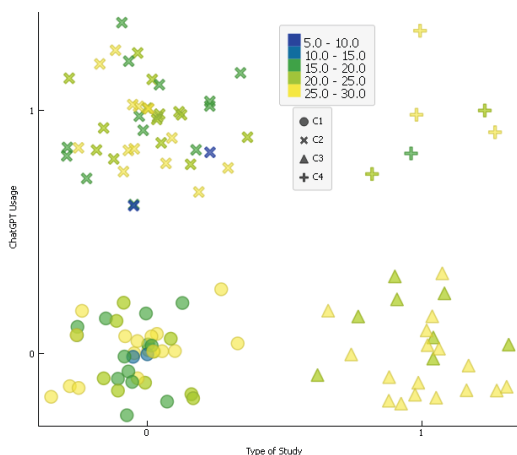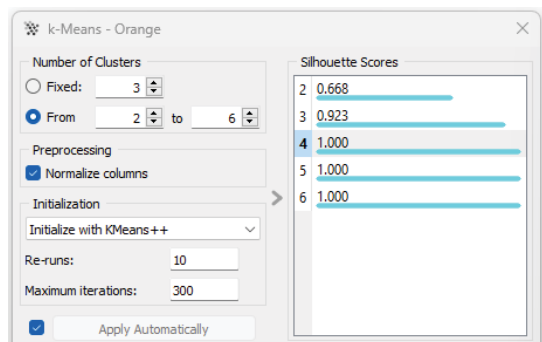

Figure 9. k-Means cluster calculation Figure 10. k-Means clusters visualisation

Identified clusters support acceptance of H2a that online students are more likely to use ChatGPT irresponsibly as well as acceptance of H2b that online students who use ChatGPT irresponsibly underperform on exams.

DISCUSSION

Main Findings

Results of the research show that 43% of students were identified to have used ChatGPT irresponsibly. Most of the prior studies have focused on the overall use of ChatGPT among university students. Research done by Fahri et al. (2023) identified that 43% of students were familiar with AI tools and that 20% were using them to complete tasks and projects. A study by Smolansky et al. (2023) found that about 29% of students in Australia and 24% of students in the US were using ChatGPT regularly for coursework. Compared to these results, not only was the ChatGPT usage higher, but it is the irresponsible usage of this tool that is this high. One of the reasons may be the significant number of online students who do not have regular supervision and interaction with the teachers. Another contributing factor may be the time period since the aforementioned papers are from 2023.

This research confirmed the impact of irresponsible ChatGPT usage on academic performance. Irresponsible usage was found to have a negative, though not strong, impact on academic performance. This finding supports previous findings by Abbas, Jam and Khan (2023) that students who often used ChatGPT for their academic assignments had poor GPAs. In the studies where academic achievement was measured by self-reported perceived progress or improvement, AI tool usage is viewed as positively impacting critical thinking and cognitive abilities (Jaboob, Hazaimeh, and Al-Ansi, 2024).

An interesting finding from this research is the degree of difference between traditional and online students in the context of ChatGPT usage and consequent performance in exams. Online students significantly use AI in a way that negatively impacts their exam results and their knowledge. This supports the indicated findings of risks associated with inappropriate AI usage or overreliance on these tools (Kasneci et al., 2023; Chan and Hu, 2023; Qawqzeh, 2024). Lack of interaction with the teachers and insufficient knowledge about the appropriate

use of AI are likely to result in irresponsible ChatGPT usage, compromised academic integrity and insufficient deep engagement with required coursework (Lim et al., 2023).

Theoretical contribution

The theoretical contribution of this paper is threefold. Firstly, this is one of the few studies that uses quantitative measures of academic performance to evaluate the influence of AI tool usage by university students (Abbas, Jam, and Khan, 2023). Exam points should be a more objective, quantified proof of students' knowledge development. Secondly, this research supports prior studies which have found that irresponsible, unethical, or inappropriate use of ChatGPT negatively impacts the academic performance of university students (Abbas, Jam, and Khan, 2023; Qawqzeh, 2024). While ChatGPT can have benefits and support students' cognitive skills (Chan and Hu, 2023; Farhi et al., 2023), it has to be adequately integrated into teaching practices and supervised by the teachers. This leads to the third relevant theoretical contribution – there is a significant proclivity for online students to use ChatGPT irresponsibly and to achieve lower exam results consequently. Being online students is the primary risk for their academic performance, as the decision tree illustrated in Figure 7 shows, but they also tend to use ChatGPT irresponsibly more than traditional students. We have not found dedicated studies which explore the relationship between academic performance and ChatGPT use for online or remote students. There are suggested benefits in terms of tailored content for self-paced study when tutoring remote students (Cotton, Cotton, and Shipway, 2024; Kasneci et al., 2023) or warnings about the need for supervised remote learning (Qawqzeh, 2024).

Practical contribution

With the constant improvement of generative AI tools and their almost unlimited accessibility to university students, academic institutions need to accelerate AI adoption and implementation practices and policy-making

Students are increasingly using generative AI tools like ChatGPT to improve their coursework (Hashmi and Bal, 2024; Šedlbauer et al., 2024) or to help them reduce the pressure and workload of assignments (Abbas, Jam, and Khan, 2023). They should be supported to learn how to use these powerful tools responsibly, and with academic integrity. The irresponsible use of ChatGPT, which is significant as found in this study, may not be intentional, but rather arising from ignorance. The academic curriculum should provide knowledge about the use of ChatGPT and other generative AI tools.

Teachers should also continue to enhance their own ChatGPT skills. On one side, to be able to recognize its use and assess students' work accordingly (Farrelly and Baker, 2023), on the other to integrate ChatGPT into coursework in ways that can stimulate students' creativity, critical thinking, analytical and evaluative skills (Qawqzeh, 2024; Smolansky et al., 2023). Special attention should be placed on tutoring online students as they are at higher risk of academic underperformance, enforced by irresponsible ChatGPT usage. With the rising number of online students, teachers' capabilities for adequate generative AI technologies implementation in curriculum as well as appropriate engagement with students are becoming critical for academic achievement.

The data we have analyzed in this study should be relatively easy to obtain by any academic institution. If captured regularly and across the entire student population, this kind of analysis can help track students' academic achievement, progress as well as academic integrity. Based on that, universities can improve relevant aspects of tutoring, coursework and assessments.

Limitations and future research

While this study offers relevant theoretical and practical contributions, it has certain limitations. The sample size is considerable, yet limited to students that attended only three marketing courses, in one country, in one school year, at only one University in Serbia. An important limitation is the evaluation of ChatGPT usage and its classification as irresponsible. Although the Scribbr tool

was used, there was a degree of subjective assessment by the teachers on what would constitute irresponsible use in available project tasks. Application of different AI detection tools and comparison of results would improve accuracy. In addition to objective measures, students' attitudes and opinions about ChatGPT usage could be explored.

CONCLUSION

Generative AI, and especially ChatGPT, are increasingly present in today's education system. Academic research aims to understand different aspects of the usage of such tools. Different studies have identified significant positive implications on students' engagement, cognitive performance, critical thinking and academic achievements. Other studies find inherent risks of ChatGPT adoption by students, with a negative impact on critical thinking, evaluative and analytical skills, academic integrity and academic achievement. This study aimed to uncover the implications of irresponsible ChatGPT use among university students in Serbia. Findings indicate that there is a negative correlation between irresponsible use of ChatGPT and academic performance. Online students are found to be more likely to engage in such behavior and achieve lower scores on exams. These findings bring a novel understanding of the impact of AI technology on academic performance and suggest practical implications for teachers, especially with regard to support for online students.

REFERENCES

1. Abbas, Muhammad, Farooq Ahmed Jam, and Tariq Iqbal Khan. 2023. "Is It Harmful or Helpful? Examining the Causes and Consequences of Generative AI Usage among University Students." *International Journal of Educational Technology in Higher Education* 21 (1). https://doi.org/10.1186/s41239-024-00444-7.
2. Abdelmagid, A. S., and A. I.M. Qahmash. 2023. "Utilizing the Educational Data Mining Techniques 'Orange Technology' for Detecting Patterns and Predicting Academic Performance of University Students."

Information Sciences Letters 12 (3): 1415–31. https://doi.org/10.18576/isl/120330.

3. Bravo-Agapito, Javier, Sonia J. Romero, and Sonia Pamplona. 2021. "Early Prediction of Undergraduate Student's Academic Performance in Completely Online Learning: A Five-Year Study." *Computers in Human Behavior* 115: 106595. https://doi.org/10.1016/j.chb.2020.106595.

4. Chan, Cecilia Ka Yuk, and Wenjie Hu. 2023. "Students' Voices on Generative AI: Perceptions, Benefits, and Challenges in Higher Education." *International Journal of Educational Technology in Higher Education* 20 (1). https://doi.org/10.1186/s41239-023-00411-8.

5. Cotton, Debby R.E., Peter A. Cotton, and J. Reuben Shipway. 2024. "Chatting and Cheating: Ensuring Academic Integrity in the Era of ChatGPT." *Innovations in Education and Teaching International* 61 (2): 228–39. https://doi.org/10.1080/14703297.2023.2190148.

6. Demšar, Janez, Tomaž Curk, Aleš Erjavec, Črt Gorup, Tomaž Hočevar, Mitar Milutinovič, Martin Možina, et al. 2013. "Orange: Data Mining Toolbox in Python." *Journal of Machine Learning Research* 14: 2349–53.

7. Driessen, Koen. 2024. "Best AI Detector | Free & Premium Tools Compared." Scribbr. 2024. https://www.scribbr.com/ai-tools/best-ai-detector/.

8. Dwivedi, Yogesh K., Nir Kshetri, Laurie Hughes, Emma Louise Slade, Anand Jeyaraj, Arpan Kumar Kar, Abdullah M. Baabdullah, et al. 2023. "'So What If ChatGPT Wrote It?' Multidisciplinary Perspectives on Opportunities, Challenges and Implications of Generative Conversational AI for Research, Practice and Policy." *International Journal of Information Management* 71 (March). https://doi.org/10.1016/j.ijinfomgt.2023.102642.

9. Eken, Süleyman. 2023. "Ethic Wars : Student and Educator Attitudes in the Context of ChatGPT." *EAI Endorsed Transactions on E-Learning* 9: 1–7. https://doi.org/10.4108/eetel.4917.

10. El-Seoud, Samir, Shehab Eldeen Ayman, Khaled Ahmed Nagaty, and Omar Karam. 2023. "The Impact of ChatGPT on Student Learning/ Performing." In *2023 International Conference on Computer and Applications (ICCA)*, 1–5. IEEE. https://doi.org/10.1109/ICCA59364.2023.10401713.

11. Farhi, Faycal, Riadh Jeljeli, Ibtehal Aburezeq, Fawzi Fayez Dweikat, Samer Ali Al-shami, and Radouane Slamene. 2023. "Analyzing the Students' Views, Concerns, and Perceived Ethics about Chat GPT Usage." *Computers and Education: Artificial Intelligence* 5 (October): 100180. https://doi.org/10.1016/j.caeai.2023.100180.

12. Farrelly, Tom, and Nick Baker. 2023. "Generative Artificial Intelligence: Implications and Considerations for Higher Education Practice." *Education Sciences* 13 (11). https://doi.org/10.3390/educsci13111109.

13. Haque, Mubin Ul, Isuru Dharmadasa, Zarrin Tasnim Sworna, Roshan Namal Rajapakse, and Hussain Ahmad. 2022. "I Think This Is the Most Disruptive Technology " Exploring Sentiments of ChatGPT Early Adopters Using Twitter Data." *ArXiv:2212.05856*, 1–12. https://doi.org/https://doi.org/10.48550/arXiv.2212.05856.

14. Hashmi, Nada, and Anjali S. Bal. 2024. "Generative AI in Higher Education and Beyond." *Business Horizons*. https://doi.org/10.1016/j.bushor.2024.05.005.

15. Hong, Wilson. 2023. "The Impact of ChatGPT on Foreign Language Teaching and Learning : Opportunities in Education and Research." *Journal of Educational Technology and Innovation* 5 (March).

16. Hussain, Sadiq, Rasha Atallah, Amirrudin Kamsin, and Jiten Hazarika. 2019. *Classification, Clustering and Association Rule Mining in Educational Datasets Using Data Mining Tools: A Case Study*. *Advances in Intelligent Systems and Computing*. Vol. 765. Springer International Publishing. https://doi.org/10.1007/978-3-319-91192-2_21.

17. Ivanov, Stanislav, Mohammad Soliman, Aarni Tuomi, Nasser Alhamar Alkathiri, and Alamir N. Al-Alawi. 2024. "Drivers of Generative AI

Adoption in Higher Education through the Lens of the Theory of Planned Behaviour." *Technology in Society* 77 (December 2023): 102521. https://doi.org/10.1016/j.techsoc.2024.102521.

18. Jaboob, Mohammed, Manar Hazaimeh, and Abdullah M. Al-Ansi. 2024. "Integration of Generative AI Techniques and Applications in Student Behavior and Cognitive Achievement in Arab Higher Education." *International Journal of Human-Computer Interaction* 0 (0): 1–14. https://doi.org/10.1080/10447318.2023.2300016.

19. Kasneci, Enkelejda, Kathrin Sessler, Stefan Küchemann, Maria Bannert, Daryna Dementieva, Frank Fischer, Urs Gasser, et al. 2023. "ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education." *Learning and Individual Differences* 103 (February). https://doi.org/10.1016/j.lindif.2023.102274.

20. Lim, Weng Marc, Asanka Gunasekara, Jessica Leigh Pallant, Jason Ian Pallant, and Ekaterina Pechenkina. 2023. "Generative AI and the Future of Education: Ragnarök or Reformation? A Paradoxical Perspective from Management Educators." *International Journal of Management Education* 21 (2): 100790. https://doi.org/10.1016/j.ijme.2023.100790.

21. Lund, Brady D., Ting Wang, Nishith Reddy Mannuru, Bing Nie, Somipam Shimray, and Ziang Wang. 2023. "ChatGPT and a New Academic Reality: Artificial Intelligence-Written Research Papers and the Ethics of the Large Language Models in Scholarly Publishing." *Journal of the Association for Information Science and Technology* 74 (5): 570–81. https://doi.org/https://doi.org/10.1002/asi.24750.

22. Mamula Nikolić, Tatjana. 2024. "THE ROLE OF DISRUPTIVE AND NON-DISRUPTIVE INNOVATION IN THE BUSINESS ECOSYSTEM." In *3rd International Conference. „Conference on Advances in Science and Technology" COAST 2024*. Herceg Novi, Montenegro.

23. Mijwil, Maad M, Kamal Kant Hiran, Ruchi Doshi, Manish Dadhich, and Indu Bala. 2023. "ChatGPT and the Future of Academic Integrity in

the Artificial Intelligence Era : A New Frontier." *Al-Salam Journal for Engineering and Technology* 2 (2): 116–27. https://doi.org/https://doi.org/10.55145/ajest.2023.02.02.015.

24. Mohi, Zahraa Raji. 2020. "Orange Data Mining as a Tool to Compare Classification Algorithms." *Dijlah Journal of Sciences and Engineering*, no. 3: 13–23.

25. Mosaiyebzadeh, Fatemeh, Seyedamin Pouriyeh, Reza M. Parizi, Nasrin Dehbozorgi, Mohsen Dorodchi, and Daniel Macêdo Batista. 2023. "Exploring the Role of ChatGPT in Education : Applications and Challenges." In *The 24th Annual Conference on Information Technology Education (SIGITE '23)*, 84–89. Marietta, GA, USA. https://doi.org/10.1145/3585059.3611445.

26. Ng, Davy Tsz Kit, Jac Ka Lok Leung, Samuel Kai Wah Chu, and Maggie Shen Qiao. 2021. "Conceptualizing AI Literacy: An Exploratory Review." *Computers and Education: Artificial Intelligence* 2: 100041. https://doi.org/10.1016/j.caeai.2021.100041.

27. Perkins, Mike, Jasper Roe, Darius Postma, James McGaughran, and Don Hickerson. 2024. "Detection of GPT-4 Generated Text in Higher Education: Combining Academic Judgement and Software to Identify Generative AI Tool Misuse." *Journal of Academic Ethics* 22 (1): 89–113. https://doi.org/10.1007/s10805-023-09492-6.

28. Qadir, Junaid. 2023. "Engineering Education in the Era of ChatGPT : Promise and Pitfalls of Generative AI for Education." In *IEEE Global Engineering Education Conference (EDUCON)*.

29. Qawqzeh, Yousef. 2024. "Exploring the Influence of Student Interaction with ChatGPT on Critical Thinking, Problem Solving, and Creativity." *International Journal of Information and Education Technology* 14 (4): 596–601. https://doi.org/10.18178/ijiet.2024.14.4.2082.

30. Raitskaya, L. K., and M. R. Lambovska. 2024. "Prospects for ChatGPT Application in Higher Education : A Scoping Review of International Research." *Integration of Education* 28 (1): 10–21. https://doi.org/10.15507/1991-9468.114.028.202401.010-021.

31. Royer, Christof. 2024. "Outsourcing Humanity? ChatGPT, Critical Thinking, and the Crisis in Higher Education." *Studies in Philosophy and Education*, no. 0123456789. https://doi.org/10.1007/s11217-024-09946-3.

32. Rudolph, Jürgen, Samson Tan, and Shannon Tan. 2023. "ChatGPT: Bullshit Spewer or the End of Traditional Assessments in Higher Education?" *Journal of Applied Learning and Teaching* 6 (1): 342–63. https://doi.org/10.37074/jalt.2023.6.1.9.

33. Šedlbauer, Josef, Jan Činčera, Martin Slavík, and Adéla Hartlová. 2024. "Students' Reflections on Their Experience with ChatGPT." *Journal of Computer Assisted Learning*, no. May 2023: 1–9. https://doi.org/10.1111/jcal.12967.

34. Smolansky, Adele, Andrew Cram, Corina Raduescu, Sandris Zeivots, Elaine Huber, and Rene F. Kizilcec. 2023. "Educator and Student Perspectives on the Impact of Generative AI on Assessments in Higher Education." *L@S 2023 - Proceedings of the 10th ACM Conference on Learning @ Scale*, 378–82. https://doi.org/10.1145/3573051.3596191.

35. Vargas-Murillo, Alfonso Renato, Ilda Nadia Monica de la Asuncion Pari-Bedoya, and Francisco de Jesús Guevara-Soto. 2023. "Challenges and Opportunities of AI-Assisted Learning: A Systematic Literature Review on the Impact of ChatGPT Usage in Higher Education." *International Journal of Learning, Teaching and Educational Research* 22 (7): 122–35. https://doi.org/10.26803/ijlter.22.7.7.

36. Xu, Zhihong, Yingying Zhao, Jeffrey Liew, Xuan Zhou, and Ashlynn Kogut. 2023. "Synthesizing Research Evidence on Self-Regulated Learning and Academic Achievement in Online and Blended Learning Environments: A Scoping Review." *Educational Research Review* 39 (October 2020): 100510. https://doi.org/10.1016/j.edurev.2023.100510.

37. Yu, Hao. 2024. "The Application and Challenges of ChatGPT in Educational Transformation: New Demands for Teachers' Roles." *Heliyon*. Elsevier Ltd. https://doi.org/10.1016/j.heliyon.2024.e24289.

38. Zhou, Jianlong, Andreas Holzinger, Life Sciences Vienna, and Fang Chen. 2023. "Ethical ChatGPT: Concerns, Challenges, and Commandments." *ArXiv*.